

CLAIMS

1 1. A self-cleaning colloidal slurry composition for superfinishing a surface of a substrate,
2 the self-cleaning colloidal slurry composition comprising:
3 a carrying fluid;
4 colloidal particles;
5 etchant for etching the substrate;
6 a surfactant adsorbed and/or precipitated onto a surface of at least one of the substrate and
7 the colloidal particles, the surfactant having a hydrophobic section that forms a steric hindrance
8 barrier between the substrate and the colloidal particles.

1 2. The self-cleaning colloidal slurry composition as recited in claim 1, wherein the
2 substrate is selected from a group consisting of a glass disk substrate, a ceramic disk substrate,
3 and a glass-ceramic disk substrate for use in a data storage device.

1 3. The self-cleaning colloidal slurry composition as recited in claim 2, wherein the
2 substrate is a silicate-based glass disk substrate.

1 4. The self-cleaning colloidal slurry composition as recited in claim 1, wherein the
2 colloidal particles include colloidal silica particles, the surfactant is a nonionic surfactant and/or
3 cationic, and the self-cleaning colloidal slurry composition has a pH of approximately 0 to 4.

1 5. The self-cleaning colloidal slurry composition as recited in claim 4, wherein the self-
2 cleaning colloidal slurry composition has a pH of approximately 0.8 to 3.0.

1 6. The self-cleaning colloidal slurry composition as recited in claim 5, wherein the self-
2 cleaning colloidal slurry composition has a pH of approximately 1.0 to 2.0.

1 7. The self-cleaning colloidal slurry composition as recited in claim 1, wherein the
2 colloidal particles include colloidal silica particles, the surfactant is a cationic quaternary amine
3 surfactant, and the self-cleaning colloidal slurry composition has a pH of approximately 7 to 12.

1 8. The self-cleaning colloidal slurry composition as recited in claim 1, wherein the
2 colloidal particles include colloidal alumina or colloidal silica coated with alumina, and the self-
3 cleaning colloidal slurry composition has a pH of approximately 3.5 to 10.5.

1 9. The self-cleaning colloidal slurry composition as recited in claim 4, wherein the
2 colloidal silica particles have a nominal size of approximately 2 - 200 nm.

1 10. The self-cleaning colloidal slurry composition as recited in claim 6, wherein the
2 colloidal silica particles include colloidal silica spheres having a nominal size of approximately 7
3 nm.

1 11. The self-cleaning colloidal slurry composition as recited in claim 3, wherein the etchant
2 is a metal etchant selected from a group consisting of Ce, Zr, Ti, Fe, Sn, Al, Cr, Ni, Mn and Zn,
3 and combinations thereof, and wherein the metal etchant is present in solution and/or as a colloid
4 and/or as an ion on the colloidal particles.

1 12. The self-cleaning colloidal slurry composition as recited in claim 1, wherein the etchant
2 is an acid or base solution.

1 13. The self-cleaning colloidal slurry composition as recited in claim 1, wherein the
2 surfactant is a nonionic and/or cationic surfactant selected from a group consisting of oxygen
3 containing compounds and nitrogen containing compounds, and combinations thereof.

1 14. The self-cleaning colloidal slurry composition as recited in claim 13, wherein the
2 nonionic surfactant is an oxygen containing compound with moieties of ethylene oxide and/or
3 polyvinyl alcohol.

1 15. The self-cleaning colloidal slurry composition as recited in claim 13, wherein the
2 nonionic and/or cationic surfactant is a nitrogen containing compound selected from a group
3 consisting of alkaloids and amines, and combinations thereof.

1 16. The self-cleaning colloidal slurry composition as recited in claim 13, wherein the
2 nonionic and/or cationic surfactant is a polydentate adsorption surfactant.

1 17. The self-cleaning colloidal slurry composition as recited in claim 1, wherein the
2 surfactant is a cationic surfactant.

1 18. The self-cleaning colloidal slurry composition as recited in claim 1, wherein the
2 surfactant is selected from a group consisting of anionic surfactants and quaternary amine
3 surfactants.

1 19. A process for superfinishing a surface of a substrate, the process comprising the steps
2 of:
3 applying a self-cleaning colloidal slurry to the surface of the substrate, the self-cleaning
4 colloidal slurry comprising
5 a carrying fluid,
6 colloidal particles,
7 etchant for etching the substrate,
8 a surfactant adsorbed and/or precipitated onto a surface of at least one of the
9 substrate and the colloidal particles, the surfactant having a hydrophobic section that forms a
10 steric hindrance barrier between the substrate and the colloidal particles;
11 mechanically rubbing the surface of the substrate with a pad while contacting the surface of
12 the substrate with the self-cleaning colloidal slurry.

1 20. The process as recited in claim 19, wherein the substrate is selected from a group
2 consisting of a glass disk substrate, a ceramic disk substrate, and a glass-ceramic disk substrate
3 for use in a data storage device.

1 21. The process as recited in claim 20, wherein the substrate is a silicate-based glass disk
2 substrate.

1 22. The process as recited in claim 19, wherein the surfactant is a nonionic and/or cationic
2 surfactant selected from a group consisting of oxygen containing compounds and nitrogen
3 containing compounds, and combinations thereof.

1 23. The process as recited in claim 22, wherein the nonionic surfactant is an oxygen
2 containing compound with moieties of ethylene oxide and/or polyvinyl alcohol.

1 24. The process as recited in claim 22, wherein the nonionic and/or cationic surfactant is a
2 nitrogen containing compound selected from a group consisting of alkaloids and amines, and
3 combinations thereof.

1 25. The process as recited in claim 22, wherein the nonionic and/or cationic surfactant is a
2 polydentate adsorption surfactant.

1 26. The process as recited in claim 19, wherein the surfactant is a cationic surfactant.

1 27. The process as recited in claim 19, wherein the surfactant is selected from a group
2 consisting of anionic surfactants and quaternary amine surfactants.

1 28. The process as recited in claim 19, further comprising the step of cleaning the surface
2 of the substrate using standard soap solutions, wherein the cleaning step is performed after the
3 step of mechanically rubbing the surface of the substrate with the pad while contacting the
4 surface of the substrate with the self-cleaning colloidal slurry, and wherein the cleaning step
5 removes substantially all of the remaining contamination from the surface of the substrate, the
6 remaining contamination being at least partially due to the colloidal particles in the self-cleaning
7 colloidal slurry.

1 29. A disk substrate for use in a data storage device, the disk substrate comprising:
2 substrate material having a surface roughness of less than 2 Å; the substrate material being
3 selected from a group consisting of glass, ceramic, and glass-ceramic; and the substrate material
4 having essentially no surface contamination even though the surface of the substrate material was
5 not subjected to a cleaning process that utilized etching or micropolishing or cleaning polish
6 etch, or a combination thereof, to remove contaminants therefrom.

1 30. The disk substrate as recited in claim 29, wherein the substrate material is a silicate-
2 based glass.

1 31. A data storage disk for use in a data storage device, comprising:
2 a disk substrate comprising a substrate material having a surface roughness of less than 2
3 Å; the substrate material being selected from a group consisting of glass, ceramic, and glass-
4 ceramic; and the substrate material having essentially no surface contamination even though the
5 surface of the substrate material was not subjected to a cleaning process that utilized etching or
6 micropolishing or cleaning polish etch, or a combination thereof, to remove contaminants
7 therefrom;
8 a recording layer applied over at least one surface of the disk substrate.

1 32. The data storage disk as recited in claim 31, wherein the substrate material is a silicate-
2 based glass.

1 33. A data storage device, comprising:

2 a data storage disk comprising a disk substrate, the disk substrate comprising a substrate
3 material having a surface roughness of less than 2 Å; the substrate material being selected from a
4 group consisting of glass, ceramic, and glass-ceramic; the data storage disk further comprising a
5 recording layer applied over at least one surface of the disk substrate; and the substrate material
6 having essentially no surface contamination even though surface of the substrate material was not
7 subjected to a cleaning process that utilized etching or micropolishing or cleaning polish etch, or
8 a combination thereof, to remove contaminants therefrom;

9 a transducer;

10 an actuator provided to position the transducer relative to the data storage disk;

11 a motor provided to rotate the storage disk relative to the transducer.

1 34. The data storage device as recited in claim 33, wherein the substrate material is a
2 silicate-based glass.

1 35. A self-cleaning colloidal slurry composition for finishing a surface of a substrate, the
2 self-cleaning colloidal slurry composition comprising:
3 a carrying fluid;
4 colloidal particles;
5 etchant for etching the substrate;
6 a surfactant adsorbed and/or precipitated onto a surface of at least one of the substrate and
7 the colloidal particles, the surfactant having a hydrophobic section that forms a steric hindrance
8 barrier between the substrate and the colloidal particles.

1 36. The self-cleaning colloidal slurry composition as recited in claim 35, wherein the
2 colloidal particles have a nominal size of approximately 70 - 200 nm to provide a textured
3 surface on the substrate.

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1 37. A process for finishing a surface of a substrate, the process comprising the steps of:
2 applying a self-cleaning colloidal slurry to the surface of the substrate, the self-cleaning
3 colloidal slurry comprising
4 a carrying fluid,
5 colloidal particles,
6 etchant for etching the substrate,
7 a surfactant adsorbed and/or precipitated onto a surface of at least one of the
8 substrate and the colloidal particles, the surfactant having a hydrophobic section that forms a
9 steric hindrance barrier between the substrate and the colloidal particles;
10 mechanically rubbing the surface of the substrate with a pad while contacting the surface of
11 the substrate with the self-cleaning colloidal slurry.

1 38. The process as recited in claim 37, further comprising the step of cleaning the surface
2 of the substrate using standard soap solutions, wherein the cleaning step is performed after the
3 step of mechanically rubbing the surface of the substrate with the pad while contacting the
4 surface of the substrate with the self-cleaning colloidal slurry, and wherein the cleaning step
5 removes substantially all of the remaining contamination from the surface of the substrate, the
6 remaining contamination being at least partially due to the colloidal particles in the self-cleaning
7 colloidal slurry.

1 39. The process as recited in claim 37, wherein the step of mechanically rubbing the
2 surface of the substrate with a pad while contacting the surface of the substrate with the self-
3 cleaning colloidal slurry provides a textured surface on the substrate.